

WHAT IS CLAIMED IS:

1. A motor control apparatus comprising:

a semiconductor switching device provided in a current conduction path of a motor;

5 a driving circuit for carrying out an operation to generate a control signal for turning the semiconductor switching device on and off; and

an over-current protection circuit for outputting an abnormality detection signal for stopping the operation carried out by the driving circuit when a current flowing through the  
10 motor exceeds a predetermined threshold value,

wherein the over-current protection circuit is for repeatedly carrying out a timer operation to stop the abnormality detection signal for an ON time period set in advance before producing the abnormality detection signal for  
15 an OFF time period also set in advance when the current flowing through the motor exceeds a predetermined threshold value, and

for controlling to lengthen the OFF time period to a relatively larger value in comparison with the ON time period by such a difference that, the larger the current flowing  
20 through the motor, the larger the difference during the operation period of the timer operation.

2. A motor control apparatus according to claim 1,  
25 wherein:

the over-current protection circuit includes:

a latch circuit for outputting the abnormality

detection signal in a set state;

a first ON-timer and a first OFF-timer for alternately carrying out first ON- and OFF-timer operations respectively when the current flowing through the motor exceeds a first predetermined threshold value; and

a second ON-timer and a second OFF-timer for alternately carrying out second ON-and OFF-timer operations respectively when the current flowing through the motor exceeds a second predetermined threshold value greater than the first predetermined threshold value;

the first ON-timer has a configuration for setting the latch circuit at the end of the first ON-timer operation and for ceasing the first ON-timer operation when the current flowing through the motor exceeds the second predetermined threshold;

the first OFF-timer has a configuration for resetting the latch circuit at the end of the first OFF-timer operation and for ceasing the first OFF-timer operation when the current flowing through the motor exceeds the second predetermined threshold;

the second ON-timer has a configuration for setting the latch circuit at the end of the second ON-timer operation;

the second OFF-timer has a configuration for resetting the latch circuit at the end of the second OFF-timer operation; and

a ratio of the duration of the second OFF-timer operation to the duration of the second ON-timer operation is

greater than a ratio of the duration of the first OFF-timer operation to the duration of the first ON-timer operation.

3. A motor control apparatus according to claim 1, further comprising:

a signal processing circuit for outputting a pulse width modulation signal having a duty ratio depending on an input voltage to the driving circuit; and

an input signal conversion circuit for supplying a direct current voltage signal produced as a result of integration of a pulse train output level command signal received from an external source to the signal processing circuit,

wherein the input signal conversion circuit has a configuration including a discharge circuit for pulling down the direct current voltage signal to a zero level when the over-current protection circuit outputs the abnormality detection signal.

4. A motor control apparatus comprising:

a semiconductor switching device provided in a current conduction path of a motor;

a driving circuit for carrying out an operation to generate a control signal for turning the semiconductor switching device on and off; and

an over-current protection circuit for outputting an abnormality detection signal for stopping the operation carried

out by the driving circuit when a current flowing through the motor exceeds a predetermined threshold value,

wherein the over-current protection circuit includes

first comparing means for comparing the current of the motor with a first threshold value to produce a first signal when the current exceeds the first threshold value;

second comparing means for comparing the current of the motor with a second threshold value higher than the first threshold value to produce a second signal when the current exceeds the second threshold value;

timer means for measuring a predetermined time period in response to the first signal; and

latch means for latching an abnormality of the current of the motor to produce the abnormality detection signal, when the second signal is produced from the second comparing means within the predetermined time period measured by the timer means.